LETTERS TO THE EDITOR.

Cracking in ice.

I NOTICED recently a peculiar cracking in ice. Snow had fallen to the depth of about a foot, and had been followed by a cold rain; so that the snow was covered with a layer of ice about three-quarters of an inch thick. The snow immediately under the ice was more firmly packed than that farther down; so that pieces broken out had their under-surfaces covered to a depth of about three inches with closely-packed snow.

The cracks seemed to run over the field irregularly, without regard to the conformation of the surface. In one or two cases they seemed to have a 'radiant' point in a bunch of thistles. Their peculiarity was in the fact, that, for a great part of their extent, they were almost perfect sinusoid curves. Where a crack began, or joined another, it would run quite straight for ten or twelve feet; and then the curves would commence. Most of the curves were of the same size,—about three feet and a half from crest to crest. The two edges of the ice where the crack was were separated about a quarter of an inch to half an inch, and one was uniformly a little higher than the other.

JACOB REIGHARD.

La Porte, Ind., Feb. 10.

Caterpillars eaten by a kitten.

One of our beautiful springs was sadly rifled of beauty and comfort by severe inroads of insects. Elms of noble promise hung around my lawns chiefly as chandeliers for the constant descent of canker-worms. Following the gardener, a pet kitten was attracted by this novel harvest. She ate the caterpillars with infinite relish; and so long as canker-worms hung from the trees, so long did the kitten pass her time in constant leaping after the pendant worms. Among my birds, only my little Black-cap was her rival in rapid voracity. Fed by them as gathered *in bowls*, the mocking-bird was not to be named in comparison with either. M. C. SPARKS.

Badly crystallized wrought iron.

This seems to be such a condition of affairs as is pointed out by Mr. Kirkaldy, who shows that a crystalline fracture is not an indication of the strength of material, but simply of the way in which rupture is effected. A sudden fracture always shows crystalline constitution. In the broken walking-beam referred to by Mr. T. M. Clark (p.169), the exterior layers doubtless yielded gradually, and the interior layers suddenly; which accounts for the crystalline appearance in the latter case, and the fibrous appearance in the former. I think similar cases will be found reported in Mr. Kirkaldy's excellent work. C. S.

Radiant heat, and the second law of thermodynamics.

The application made by Prof. J. W. Gibbs of the doctrine of radiation (SCIENCE, p. 160) would seem to me in all points to be correct, were it not really a question of the composition of velocities, of which no sufficient account seems to be taken.

To make this clear, suppose a body (such, for example, as a right cylinder) to be projected lengthwise in empty space of uniform temperature, with a velocity equal to that of radiant heat. No heat can then overtake its rear surface: hence its front will receive a double amount, and so have its temperature augmented; thus causing heat to flow along the cylinder from front to rear. But any disturbance of temperatures, such as this, is in apparent contradiction to the proposed application of the doctrine of radiations, which attempts to prove in general that no changes of temperature can arise from the motions of bodies. It is not quite certain that this would also constitute an exception to the second law, although it may well do so, because the radiations encountered may possibly cause a pressure upon the front surface; though it is difficult to see how this can be so in case it is entirely black. This illustration, then, which needs more complete discussion, will at least serve to make evident the necessity of taking into account the velocities of moving bodies in cases in which no such pressures oppose their motion. This is what has been attempted in the brief computation contained in the original paper;[1] and it seems to be admitted, in so far as direct exchanges of radiant heat between A and B are concerned, that more is transmitted in one direction along a line of apertures, $a\ c\ b$, than in the other.

Now, suppose the screens to be non-conducting, and enclosed by a non-conducting cylindrical surface; also let the entire interior of the cylinder and screens be perfectly reflecting. Then no part of the interior can be a continuous source of radiant heat. The enclosed space is also excluded from exchanges with all bodies except A and B, and these only exchange heat through apertures in the screens.

It appears possible, by suitable reflectors moving with the screens, to return to A and B respectively all heat radiated from each which does not pass through the screen c. Now, if a less amount of heat pass in one direction through the apertures $a\ c\ b$ than in the other, then, in order that equilibrium may continue, more heat must pass through c along other lines. But, as there are no sources of heat in the interior, this cannot continue, although true at the start. It is therefore sufficient, in attempting to establish the proposed process as an exception to the second law, to show, as has been attempted, that more heat is transmitted directly from A to B than from B to A; since their exchanges with other bodies and parts of the apparatus may be left out of the account, as was tacitly assumed in the original paper. H. T. EDDY.

[1] Journ. Frankl. inst., March.

Keweenaw-point geology.

On account of certain statements in Prof. R. D. Irving's letter in SCIENCE, March 9, it seems proper to attempt to undeceive him regarding the position of some geologists towards the evidence of the Wisconsin survey, and to make clearer to others the points of discussion. That evidence has neither been ignored nor denied by them; but, while willing to grant its correctness, they deny the conclusions that Irving and his associates have drawn therefrom. Foster and Whitney, in 1850, clearly showed that the copper-bearing traps were a series of lava-flows, between which, in many places, were conglomerate and sandstone beds, composed, in part, of the *débris* of the underlying lava. These detrital deposits were laid down on one lava-flow, and then the succeeding flow was poured over all. Later, Mr. A. R. Marvine brought forward full evidence of the same kind. The present writer also collected similar proof, and, in addition, showed that the traps overflowed and indurated the eastern sandstone.

The structure of the district along a line extending obliquely from Torch Lake to Copper Falls, across the eastern trappean belt, and uniting the sandstone on both sides, is as follows: On the eastern side of Keweenaw Point a series of sandstone and conglomerate beds was laid down, having a gentle but increasing dip as the traps are approached; over these poured the first lava-flow, indurating the underlying